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THE COMPARATIVE ANALYSIS OF THE NUMBER OF OCCUPATIONAL INJURIES IN SERBIA, CROATIA AND SLOVENIA IN 2012

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Abstract. *The aim of this work is to establish key performance indicators and causes of occupational injuries in terms of occupational safety, through the research and by analyzing the number of occupational injuries as key indicators of health and safety at workplace in a particular country, with the aim to systematically act to eliminate them. In order to collect data, the empirical research on the number of injuries and the causes of their development was conducted in Serbia, Croatia and Slovenia. The analysis of the results clearly indicates that managing employees' health and safety risks and their removal, i.e. their reduction to an acceptable level should be the priority for every country with the purpose to raise occupational safety and health to the highest possible level.*

Key words: *occupational injury, comparative analysis, Serbia, Croatia, Slovenia*

1. INTRODUCTION

Occupational injury, as defined in Article 22 of the Law on Pension and Disability Insurance, is considered to be an injury inflicted on an Insured Party, relating in space, time and causality to performing his/her work, based on which he/she is insured, caused by an immediate and momentary mechanical, physical or chemical impact/exposure, a sudden change in body position, a sudden and unexpected exertion of the body, or other changes in the physiological condition of the body [13]. The problems related to occupational injuries are important both to the individual who has suffered an injury at work and the company in which the injured worker is employed, as well as the society in general.

The occupational injuries are, together with professional diseases, the most important indicator of the workers' health [2, 3]. One of the traditional indicators of the degree of

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the development of occupational safety in a social environment is the number of occupational injuries that occur to employees in a particular period of time.

The process of analysis of occupational injuries can be observed through the five-step circular cycle:

1. The analysis of the gathered information;
2. Determination of the consequences of occupational injuries;
3. Analysis of the spent resources;
4. Defining measures for preventing the number and severity of occupational injuries;
5. Monitoring the measures taken and gathering feedback information [12].

The analysis of gathered information is the first step in the analysis of occupational injuries and it is based on the analysis of existing information. The crucial influence on the result of the analysis is the quality of available information that a company possesses - the better quality of information is, the more substantial and accurate they are, and therefore, the analysis itself is more accurate and has more practical significance.

The first task is the analysis of occupational injuries according to the following criteria:

a. The number of injuries per 1000 employees;
b. The frequency index determination.

The number of accidents in a certain period of time shows the trend of injuries and serves as the main proof of the quality of implemented occupational health and safety policies.

a. The rate of injuries is the ratio of the number of occupational injuries in a given period of time compared to the average number of employees.

The evaluation criteria of the injuries rate are shown in Table 1:

Table 1 The criteria for evaluating the rate of injuries [11]

The rate of injuries	The number of injured
Low rate	if up to 2.0% of employees get injured
Moderate (elevated) rate	if 2.1 – 4.0% of employees get injured
High rate	if 4.1 – 6.0% of employees get injured
Extremly (enormously) high rate	if 6.1% and more get injured

b. The incidence of injuries is determined as the ratio of the number of injured at work in the given period and the number of actual working hours of all workers in the analyzed period, i.e. according to the formula:

$$\mathrm{FI} = \frac{\mathrm{NI} \cdot 1,000,000}{\mathrm{WH}} \tag{1}$$

wherein: FI - frequency index; NI - total number of occupational injuries; WH - total number of actual working hours in the period; 1,000,000 - constant.

A number between 5 and 10 generated at 1,000,000 of actual working hours is considered to be a tolerable value of the frequency index.

Determining the consequences of occupational injuries. The costs that arise as a result of occupational injuries are very complex, mainly due to the lack of clear measurement and expression in monetary units of the consequences of all occupational injuries. This paper focuses only to the expenses related to the cost of sick leave due to occupational injuries.

To determine the index of difficulty ID of occupational injuries, the following data are required:

a. The actual number of working days lost (LWD);
b. Time charging related to the estimation of future losses as a result of death, partial or total disability (TC);
c. The total number of actual effective working hours in the observed time interval (EWH).

$$ID = \frac{(LWD+TC)\cdot 1,000}{EMH} \quad (2)$$

wherein: 1,000 - constant.

Tolerant value of the index of difficulty is when the value of the index ranges from 0.5 to 1.00 working days lost per 1000 actual working hours. A detailed analysis for ther year 2008, due to one fatal injury at work, set the index of difficulty of 0.66 working days lost per 1,000 of working hours [11].

Analysis of spent resources. The consumed resources can be classified according to two criteria:

a. The costs that arise as a result of occupational injuries (the cost of sick leave, lost working hours, the cost of repairing the damaged tools, lost profits, compensations paid to an injured, etc.);
b. The costs/investments in order to reduce the number and severity of occupational injuries (investment in personal protective equipment, training employees for safe work, continuous education, the cost of collective insurance against occupational injuries).

The costs arising as a result of occupational injuries are a result of incurred subjective or objective failures. Some of the costs can be easily measured in monetary units (cost of sick leave, compensation paid to an injured worker, etc.). According to the research by the ILO (International Labor Organization), there are four units that cannot be easily measured and expressed in monetary per one monetary unit. Therefore, it is very important to gather all possible information related to the occupational injuries as well as the financial costs that arise or are caused by occupational injuries.

A particular issue is the second criteria for analyzing the resources spent and it concerns the nature of costs arising as a result of preventive activities for safer working conditions (purchasing the appropriate personal protective equipment, education and training for safe work, examination of working environment and work tools, medical examination, collective insurance for basic injuries, etc.).

Defining the measures for preventing the number and severity of occupational injuries. The goal of each legal entity should be to reduce the number of occupational injuries. Defining the measures in order to avoid occupational injuries can be classified into several categories:

a. Giving due attention to the organization of work activities and the design of the working environment, space and testing work tools;
b. Continuous training of employees for safe work with active control of the acquired knowledge and motivation of employees to apply the acquired knowledge;
c. Procurement of adequate means for personal protective equipment;
d. Continuous monitoring of workers' health [14].

One of the best ways to prevent and control occupational injuries is an appropriate minimum "Design of danger" and hazardous occupational exposure. The concept of PtD

(*prevention through design*) involves designing work spaces, structures, tools, plant, machinery and equipment, methods and systems of work. Legislative Activity in the Republic of Serbia also supports this concept by adopting the Regulation on Safety and Health Requirements on temporary and mobile construction sites. Immediately after organizing the workspace, it is necessary to define all work operations in a work process. After defining the operations, it is necessary to identify all the risks and hazards that employees on the workplace are exposed to.

The training of the employees for safe work based on the defined risks and harms for each individual job is the most important precondition for reducing the number and severity of occupational injuries. The process of training is not a static category, and in accordance with the changes in technology of work and collected information, it is necessary to organize permanent training. The control in applying the acquired knowledge is of great importance when motivating the employees to apply that kind of knowledge which has a tendency of creating safe working conditions [14].

Procurement of the appropriate personal protective equipment, as well as training employees to use them, reduces the possibility for occupational injury. According to the established risks and hazards it is necessary to purchase the appropriate personal protective equipment. Once purchased personal protective equipment are subject to periodic review of their safety and functionality. A special role of Occupational Medicine service in preventing occupational injuries is emphasized here, since its main goal is to preserve employees' working abilities.

Monitoring the measures taken and gathering information. Information is the basis for any measures to be taken in order to reduce the number and severity of occupational injuries. On the basis of adequate information it is possible to define appropriate measures for safe operation. Considering the fact that the technological process and operating conditions change, constant supervision in the implementation of measures for safe operation is required. Based on these results, it is necessary to modify the existing measures, customize the actual working conditions and formulate new policies for occupational health and safety.

2. RESEARCH METHODOLOGY

2.1. The subject and the research problem

Data on the number and severity of occupational injuries and diseases should be a key indicator of the state of safety, both at the micro level (individual legal entity) and at the macro level - the level of the state. In addition, it is particularly important in the statistical analysis, presentation and interpretation of the data, with the usual methods of descriptive statistics, to apply trend analysis based on data obtained through many years, since the established trend of occupational injuries and occupational diseases are the best illustrations of the safety condition. In addition, knowledge of trend analysis can be used as an early recognition of the crisis and timely planning of effective safety measures.

The official, professional and public reviews of occupational safety in Croatia, by analyzing the annual data on occupational injuries and occupational diseases [4, 8, 9, 10], do not apply a systematic statistical method of identifying and trends analysis. The exception is the rare use of trend analysis in the Counties of Croatia [6], so it can be concluded that there is no crucial knowledge about the trend of occupational injuries and

diseases in Croatia, as it is the case in Slovenia and Serbia; therefore, this can be identified as a *research problem*.

2.2. The aim, hypothesis and research objectives

The aim of the research is to identify key indicators of safety, especially the causes of occupational injuries, in order to systematically act to eliminate them.

Reseach tasks arising from the research objectives:

1. Collection and analysis of official data on the number of occupational injuries;
2. Identification and analysis of the most common causes of occupational injuries.

2.3. Research Methods

Considering the defined research goal, the analysis of secondary survey data has been used as an appropriate research method.

3. THE RESULTS OF THE ANALYSIS OF DATA ON OCCUPATIONAL INJURIES

3.1. Analysis of occupational injuries in the Republic of Serbia

The comparative analysis of numerous labour inspectional supervisions in 2012, in relation to 2011, indicates that the total number of fatal work-related injuries in 2012, was reduced by approximately 7% in comparison to the 2011 (in 2012 - 26 fatal injuries at work, while in 2011, 28 fatal occupational injuries occurred) and the number of serious occupational injuries resulting in death in 2012 was reduced by 28% when compared to 2011 (in 2012, there were 18 serious occupational injuries resulting in death, while in 2011, there were 13 serious occupational injuries resulting in death). At the same time, the number of inspectional supervisions was increased by 4% due to the reported serious occupational injuries due to the fact that the Labor inspectorate insists on employers to report all the injuries which may result in leave of absence, longer than three days.

Table 2 The number of inspectional supervisions and reported occupational injuries in the period 2006-2012

Year	Number of supervisions and injuries				
	Total	Deaths	Collective	Serious	Slight
2006	1,102	54	27	966	82
2007	1,330	28	28	1,140	162
2008	1,285	42	32	1,034	177
2009	1,286	37	22	1,004	223
2010	1,322	35	29	1,026	232
2011	1,082	28	24	958	54
2012	1,243	26	24	1,003	177

Source: Labour Inspectorate of the Ministry of Labour and Social Policy.

During 2012, labor inspectors conducted 1243 inspections on the occasion of death, serious injuries with fatal outcome, serious collective and slight injuries:

- 26 supervisions regarding fatal occupational injuries - 15 in the construction sector, 7 in the industry sector (2 in the activity of metals, machinery and other equipment, 2 in electricity, gas and steam production and distribution, 1 in food manufacturing, 1 in the wood processing sector and 1 in non-metallic minerals manufacture), 2 in the utility industry and recycling business, 1 in transport and storage, and 1 in agriculture, forestry and fishing;
- 13 supervisions regarding serious occupational injuries resulting in death - 7 in construction sector, 2 in the industry (1 in metal products manufacturing, machinery and other equipment, and 1 in electricity, gas and steam production and distribution), 2 in transportation and warehousing, 1 in providing accommodation and meals and 1 in agriculture, forestry and fishing;
- 1003 surveillance regarding serious occupational injuries;
- 24 supervisions regarding collective occupational injuries - 8 in the construction sector with 4 fatal outcomes, 6 serious and 10 slight occupational injuries; 6 in the industry sector, 2 in the activities of wholesale and retail trade, in which 2 serious and 2 slight injuries occurred; 2 in transport and storage activities, within which 2 serious and 2 slight injuries occurred; 2 in the education sector, within which 5 slight occupational injuries occurred; 1 in agriculture, forestry and fishery, within which 3 fatal injuries, 1 serious injury and 1 slight injury occurred; 1 in the personal services sector, within which 2 slight injuries occurred; 1 in media and communication, within which 2 slight injuries occurred; and 1 in the activities of the state administration and other activities in which 1 heavy and 1 slight occupational injuries occurred. Within these 24 collective injuries, which have been reported to the Labour inspection, a total of 59 occupational injuries (9 deaths, 16 serious and 34 slight occupational injuries) happened.
- 177 surveillances regarding slight occupational injuries [5].

3.2. Analysis of occupational injuries in the Republic of Croatia

According to the available data, the average of 20,000 workers in the Republic of Croatia get injured annualy, out of which 80% directly at work and 20% of work-related (on the way to work, and when returning back home from work), and an average of 200 people a year are diagnosed with occupational diseases. On a long-term basis, the average of 1500 workers get injured per month, out of which two workers die at work and one more in the work-related circumstances, whereas 100 people get seriously injured.

During 2012, 1.337,746 workers were employed, i.e. performed commercial and professional activities (718,067 men and 619,679 women), which is 37,239 less than in 2011. Out of this number during 2012, 15,718 people got injured (9,630 men and 6,088 women), and 33 workers died at work and eight people more died in work-related circumstances. 14,081 people got injured at the workplace (8,274 men and 3,826 women). Furthermore, on the way to work 673 men were injured, amd twice as many women were injured (1,326 women) [10].

Upon confirmation number, the manufacturing activity was the largest in terms of total number of injuries with 3,474 injuries (from a total of 231,764 employees, 31,936 of which were employed in trades and freelancers). Ships and boats buidlign and repair activities were at the top of the ladder - 384 injuries out of 12,085 employees. What follows is construction with 1,121 injured out of 97,108 employees (22,197 of which in trades), and even riskier forestry, especially wood cutting - 257 injured out of 11,091 employees.

Table 3 The number of occupational injuries by gender in 2012 [10]

Number of employees: 1,337,746	Total number of injuries		
	Men (718,067)	Women (619,388)	Dead
at workplace	8,274	3,826	33
on the way to work	673	1,326	5
on the way home	443	732	3
on bussiness trip	120	77	
other	120	127	
Total: 15,718	9,630	6,088	41

3.3. Analysis of occupational injuries in the Republic of Slovenia

According to the available data [1], in the EU there is an evident trend of reducing fatal occupational injuries, as is the case with Slovenia, where there is a significant downward trend in the number of fatal occupational injuries from 1991 onwards, as per the records of the International Labor Organization (ILO) and the Institute for Health Insurance of Slovenia. Data from the Labor Inspectorate of the Republic of Slovenia on fatal occupational injuries that happened only at work (no injuries on the way) show a significant upward trend in fatal occupational injuries since 1998 [7].

Table 4 The number of injuries and deaths at work by industry and gender in 2012

Activity	Occupational injuries					Fatalities	
	total	men	on 1,000 employed men	women	per 1000 employed women	No	on 10000 employed persons
Agriculture, hunting, forestry and fishing	237	207	18.9	30	5.7	2	1.2
Mining industry	139	137	58.6	2	5.8	1	3.7
Production	5,668	4,567	37.4	1,101	18.8	8	0.4
Electricity and gas supplying	183	169	26.8	14	9.2	-	-
Utility and Housing activity	369	338	45.4	31	14.8	-	-
Construction	1,792	1,761	33.8	31	6.2	10	1.8
Sale and repair of motor vehicles	1,856	1,045	20.3	811	14.5	-	-
Transport and storage	1,220	1,120	30.0	100	11.8	4	0.9
Catering Industry	674	281	21.5	393	21.5	-	-
Information and Communication	149	107	6.8	42	5.5	-	-
Finance and Insurance	209	67	8.0	142	9.6	-	-
Real estate	53	41	18.5	12	6.6	-	-
Professional, scientific and technical activities	494	372	14.0	122	5.3	-	-
Other bussines activities	581	368	27.5	213	17.3	1	0.4
Public administration	1,244	896	36.1	348	13.2	-	-
Education	840	195	12.3	645	12.0	-	-
Health and social protection	1,017	228	21.4	789	17.5	-	-
Arts, entertainment and recreation	215	139	19.5	76	11.2	-	-
Other activities	113	58	13.6	55	6.0	-	-
Activities of extra territorial organizations and entities	-	-	-	-	-	-	-
Unclassified	267	200	-	67	-	-	-
In total	17,320	12,296	27.9	5,024	14.0	26	0.3

Source: Institute of Public Health of the Republic of Slovenia

From the data provided above, we see that the greatest number of occupational injuries were recorded in the manufacturing sector (32.75%), sales and repair of motor vehicles (10.71%) and construction (10.35%), while, as expected, the majority of work-related deaths were recorded in the construction industry - 10 cases (38.46%), production 8 cases (30.76%) and transportation and storage 4 cases (15.38%).

4. DISCUSSION

Reduction i.e reducing to a minimum the risk of occupational injury should be a long-term goal that would amend the existing state, which indicates the importance of non-compliance with safety measures, failure to use the funds for personal protection and partial implementation of legislation.

However, despite the fact that the legislation of Croatia, Slovenia and Serbia are complied with the European legislation in this field and that all the requirements for the protection of workers are offered, the problem of its incomplete application is still obvious. According to research results, the most common causes of occupational injuries by country are as follows:

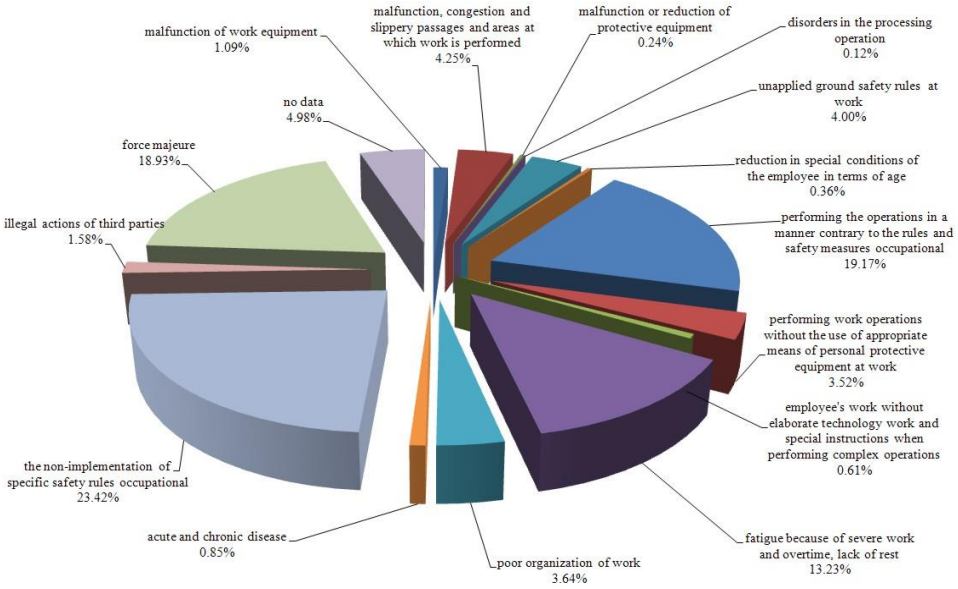

Fig. 1 Causes of severe occupational injuries in 2012 (Serbia)
Source: Department for Safety and Health at Work, Work Report for year 2012

The most common cause of occupational injuries is the non-implementation of specific occupational safety rules (23.43%), followed by performing the operations in a manner contrary to the rules and occupational safety measures (19.17%), force Majeure (18.93%) and fatigue due to severe work and overtime work, and lack of rest (13.23%).

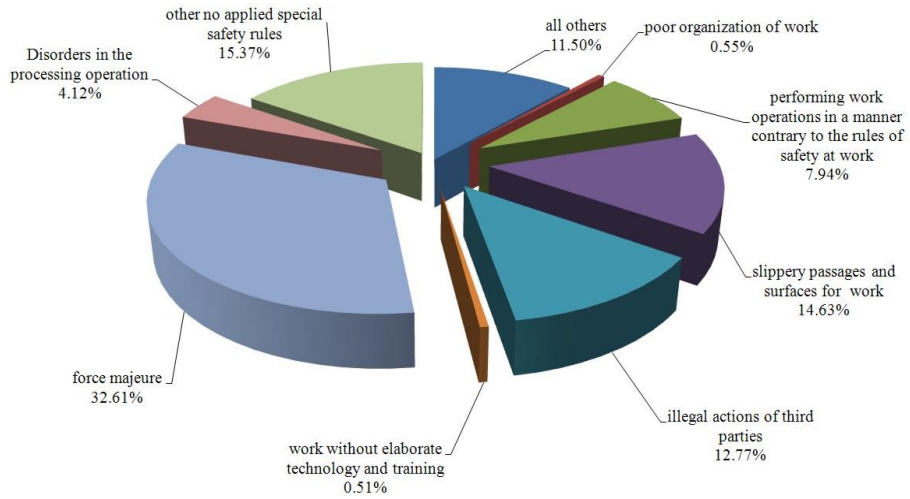

Fig. 2 Causes of severe occupational injuries in 2012 (Croatia)
Source: Croatian Institute for Public Health and Safety, Analysis of occupational injuries for the year 2012.

The most common cause of occupational injuries is force Majeure, and according to the data on occupational injuries 4590 people (32.61%) were injured due to force majeure. Because of other non-implemented special safety rules 2163 people (15.37%) were injured. What follows is malfunction, congestion and slippery passages and surfaces at the place of work operations, and that is the reason for 2060 people (14.63%) to be injured. Due to the illegal actions of third parties 1798 people (12.77%) were injured while performing work in a manner contrary to the rules of occupational safety, and as a consequence 1,118 people (7.94%) were injured.

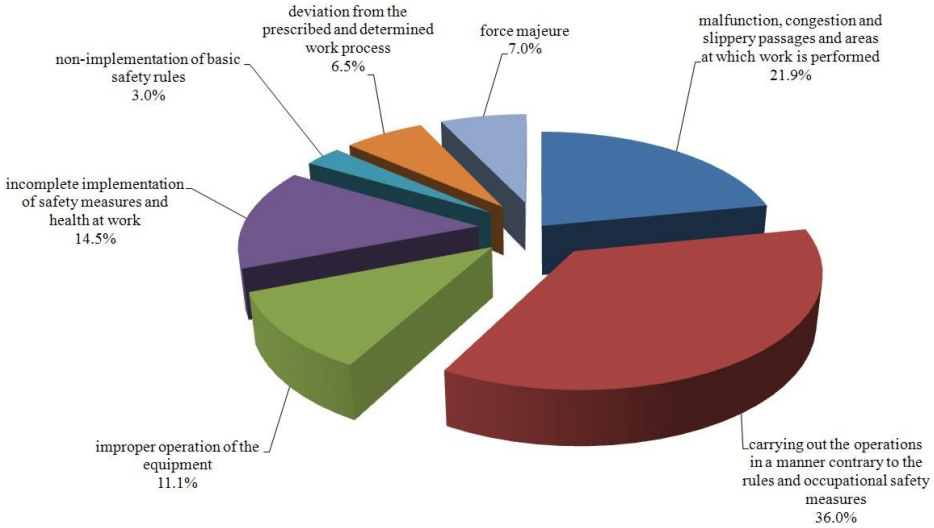

Fig. 3 Causes of severe occupational injuries in 2012 (Slovenia)
Source: Institute for Health Insurance.

The most common cause of occupational injuries is carrying out the operations in a manner contrary to the rules and occupational safety measures (36%), malfunction, congestion and slippery passages at the place of work operations (21.9%), followed by incomplete implementation of safety and health measures at work (14.5%), improper operation of the equipment (11.1%) and the deviation from the prescribed work process (6.5%).

The most common causes of injuries of the employees in Croatia, Slovenia and Serbia are the lack of training and safe working conditions in the workplace. In the process of ensuring safe place to work, there are many factors that need special attention. However, the number of occupational injuries and reports of lost lives indicate the fact that not much has been done in the field of occupational health and safety.

The aim of the policy of supervision of safety and health at work is, above all, to prevent injuries and occupational diseases, and it is based on initiation of a series of activities in several areas such as, for example, the establishment of the employer's liability in all phases of the work, the application of preventive measures both in all forms of work and engineering phases, risk assessment and management services in all areas of work, training of employees for safe and healthy work, monitoring their health status, monitoring parameters of the working conditions and the likewise.

This policy of labor inspection is justified for two reasons: first, it is used with the aim to supervise specific occupational injuries on the spot, in order to prevent such violations and, second, there is a need to establish a more accurate record of accidents at work, whose analysis would be determined by the most common causes and sources of injury, as well as planning future surveillance which will be directed towards the elimination of perceived risk.

5. CONCLUSION

By analyzing the causes and circumstances that caused occupational injuries, it was found that the most common causes of employees' injuries in 2012 were the following:

a. In The Republic of Croatia, according to the Croatian Institute for Public Health and Safety:
   - Force Majeure;
   - Other non-implemented specific rules of occupational safety;
   - Malfunction, congestion, slippery passages and areas at which work is performed;
   - Unlawful actions of third parties;
   - Performing an operation contrary to the rules of occupational safety.

b. In The Republic of Slovenia, according to the Institute for Health Insurance:
   - Malfunction, congestion and slippery passages and areas at which work is performed;
   - Incomplete implementation of occupational safety and health;
   - Improper operation of equipment operation;
   - Deviation from the prescribed and established work processes;
   - Force Majeure.

c. In The Republic of Serbia, according to the Department for Occupational Safety and Health:
   - Lack of special safety rules;
   - Performing work operations in a manner contrary to the rules of occupational safety;
   - Force Majeure;
   - Fatigue of employees due to the rough and overtime work, lack of rest;
   - Malfunction, congestion and slippery passages and areas at which work is performed;
   - Unapplied basic rules of safety;
   - Poor organization of work;
   - Performing work operations without the use of appropriate tools and equipment for personal protection.

Keeping in mind that the trends analysis of occupational injuries depicts the safety situation in a particular country, that analyzing trend is the function of early recognition of a crisis and. therefore. the timely planning and taking appropriate security measures based on the above data, it can be concluded that in the period from 2006 to 2012 there is the evident negative trend of direct victims at work in Serbia and Croatia. In Slovenia, the trend is fairly uniform, but slightly negative. In the same period in Serbia, there is a trend of increased number of inspections, the trend of reduced number of serious injuries, but also a very positive trend in the number of slight injuries. The collective injuries are relatively consistent with the presence of mildly significant negative trend.

By analyzing the percentages on the causes of serious injuries in 2012, one of the most common causes of these injuries in Croatia and Slovenia is the operation against safety rules. By comparing the percentages, this cause is statistically more explicit in Slovenia (36%) than in Croatia (15.37%). This cause in Serbia is recognized in 19.7% of cases and is statistically less significant than in Slovenia. In Serbia, the most common causes of serious injury correspond to the non-implementation of specific rules of safety, which were present in 23.43% of all cases.

The most common causes of injuries of employees in Croatia, Slovenia and Serbia are their lack of training and lack of safe working conditions in the workplace. In the process of ensuring safe places to work there are many factors that need special attention. However, the number of occupational injuries and reports of lost lives indicate the fact that not much has been done in the field of occupational safety and health.

Reduction or reducing to a minimum the risk of occupational injuries should be a long-term goal that would amend the existing state, which indicates the non-compliance with safety measures, failure to use the funds for personal protection and partial implementation of legislation. However, despite the fact that the legislation of Croatia, Slovenia and Serbia is harmonized with the European legislation in this field and that it provides all the requirements for the protection of workers, the problem of incomplete applications is evident.

The results showed that in addition to the defined causes of occupational injuries, which are common in Croatia, Slovenia and Serbia, there are those that can be marked as specific and are listed as causes only in a particular country. In summary it has been concluded that it is necessary to take concrete steps to standardize a single list of causes in order to provide better and more accurate monitoring of injuries and subsequent analysis of the data through a common list of key indicators.

An integrated system of safety that promotes a safe and healthy work environment, a clear definition of technical standards that define the scope of the organization on a permanent reduction of hazards and risks, helps organizations to, in accordance with regulations, manage the occupational health and safety risks and to thereby eliminate or reduce them to an acceptable level. Recognizing the dangers and hazards and their evaluation in order to determine the priorities for their resolution is the first step in determining the choice of preventive measures that prevent, eliminate or minimize the risk of injuries, i.e. fatalities at the workplace during the working process.

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KOMPARATIVNA ANALIZA BROJA POVREDA NA RADU U SRBIJI, HRVATSKOJ I SLOVENIJI U 2012. GODINI

Cilj ovog rada je da sprovedenim istraživanjem, kroz analizu broja povreda na radu kao ključnih pokazatelja stanja bezbednosti i zdravlja na radu u jednoj zemlji, utvrdi ključne indikatore bezbednosti na radu i uzroke povreda na radu, kako bi se sistemski delovalo na njihovo otklanjanje. U cilju prikupljanja podataka, empirijsko istraživanje broja povreda na radu i uzrocima njihovog nastajanja sprovedeno je u Srbiji, Hrvatskoj i Sloveniji. Analiza rezultata jasno ukazuje da upravljanje rizicima po zdravlje i bezbednost zaposlenih i njihovo eliminisanje tj. smanjenje na prihvatljiv nivo treba da predstavlja prioritet svake zemlje u njenom nastojanju da bezbednost i zdravlje na radu podigne na što viši nivo.

Ključne reči: *povreda na radu, komparativna analiza, Srbija, Hrvatska, Slovenija*